

## Midterm II

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Econ 253

Spring 2001

*You have 75 minutes to answer the following 5 questions. Each question is worth 20 points, so you should plan to spend an equal amount of time on each one. You may use a calculator and a single-sided sheet of paper with notes and formulas. Any collaboration is considered a violation of the honor code, as is discussing the exam with students in other sections who have not yet taken the exam. Good luck!*

1. The Good Food Company is interested in the health and fitness of its employees. The company recently sponsored an exercise session before the start of each shift and wishes to see if the program resulted in weight loss for its employees. The company surveyed 200 of its 100,000 employees before and after the program and found the following results:

before	after
$n_1 = 200$	$n_2 = 200$
$\bar{x}_1 = 180$	$\bar{x}_1 = 175$
$s_1 = 50$	$s_1 = 30$

Answer the following questions:

- (a) Did the program have a statistically significant effect on the mean weight of employees?
  - (b) Did the program significantly decrease the differences in weight among employees?
2. Suppose a pharmaceutical company claims to have found a cure for cancer. When the FDA tests the drug, its null hypothesis is that the drug is ineffective in curing the disease. Answer the following questions:
    - (a) What is the type I error in this example?
    - (b) What is the type II error?
    - (c) How would you weigh the trade off between type I and type II errors in this case? How would you set the significance level?

3. For the simple linear model  $Y_t = B_0 + B_1X_t + u_t$ , show that under certain assumptions, OLS estimates give unbiased predictions. That is, show that  $E(\widehat{Y}_t) = E(Y_t)$ . Be sure to state the assumptions essential to your answer.
4. The Office of the Registrar at a college took a random sample of 500 students and obtained their college GPA's (*COLGPA*), high school GPA's (*HSGPA*) and their combined SAT scores (*SAT*). The following model was estimated:

$$COLGPA = B_1 + B_2HSGPA + B_3SAT + u$$

The estimated slope coefficients and their standard errors are given as follows:

Coefficient	Standard Error
$b_2=0.398$	0.061
$b_3=0.0007$	0.0003
$ESS = 288$	
$RSS = 1089$	

Answer the following questions:

- (a) Test the hypothesis that the regression coefficient  $B_2 = 0$  at the 5% level of significance. Interpret your result and the estimated coefficient.
- (b) Test the hypothesis that the regression coefficient  $B_3 = 0$  at the 5% level of significance. Interpret your result and the estimated coefficient.
- (c) Calculate  $R^2$ .
- (d) Test the joint hypothesis that *HSGPA* and *SAT* do not explain college GPA.
- (e) Suppose a student decided to study hard to improve her SAT scores by 100 points. Can you tell how much would this increase her expected college GPA? (Hint: Think before jumping into the mathematics.)

5. Consider the following regression model of demand for bus travel. The data used in this study includes the following information for 40 cities across the U.S. in 1988:

- BUS = Demand for urban transportation by bus in thousands of passenger hours
- FARE = Bus fare in dollars
- INCOME = Average income PER CAPITA
- POP = Population of city in thousands

The following regression was estimated:

$$\ln(BUS) = B_1 + B_2 \ln(FARE) + B_3 \ln(INCOME) + B_4 POP + u$$

regress LNFBUS LNFARE LNINCOME POP						
Source	SS	df	MS			
Model	21.3257748	3	7.1085916	Number of obs =	40	
Residual	30.9306049	36	.859183469	F( 3, 36) =	8.27	
Total	52.2563797	39	1.33990717	Prob > F =	0.0003	
				R-squared=	0.4081	
				Adj R-squared =	0.3588	
				Root MSE =	.92692	

  

LNFBUS	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
LNFARE	-.0000508	.480407	0.000	1.000	-.9743614	.9742597
LNINCOME	-3.272351	1.248092	-2.622	0.013	-5.803599	-.7411
POP	.0006137	.0001263	4.860	0.000	.0003576	.0008698
_cons	38.26334	12.09056	3.165	0.003	13.74255	62.78414

Using the above computer output, answer the following questions:

- Which coefficients appear as significant determinants of the demand for bus travel? Are the signs of estimated coefficients consistent with your intuition? Explain.
- Is the regression jointly significant at 1% level of significance?
- What is the interpretation of the coefficient on income?
- Test the hypothesis that the demand for bus travel is unitary elastic (in absolute value) with respect to income, against the alternative that the demand is elastic. (Note: demand is considered elastic if the elasticity (in absolute value) is greater than 1 and inelastic if it is less than one.)
- What is the marginal effect of an increase in population on demand for bus travel? Explain your answer.